PATENT ABSTRACTS OF JAPAN

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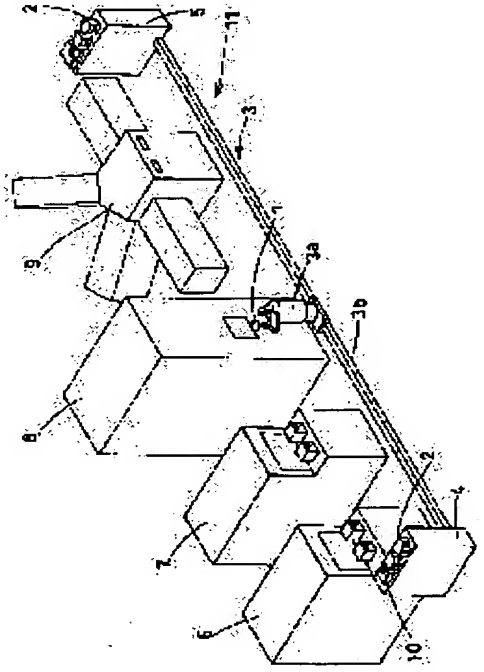
(54) MANUFACTURING METHOD AND APPARATUS FOR PROCESSED PRODUCT

(57)Abstract:
PROBLEM TO BE SOLVED: To improve productivity of processed products by making constant their processing conditions in the processing portions of a manufacturing apparatus for them so as to make uniform their qualities, and by shortening their processing times.
SOLUTION: In this apparatus, by coupling a plurality of processing portions 6-9 to each other via a single-wafer carrying mechanism 3 whereby a plurality of different processings can be applied continuously to a semiconductor substrate 1, at least one manufacturing line 11 is so formed that the single-wafer carrying mechanism 3 can carry the semiconductor substrates 1 selectively one by one to the individual processing portions 6-9. Thereby, since the processing variations of the semiconductor substrates 1 generated when processing them in the unit of batch processing are eliminated, and since their waiting times between their processing completions in a processing portion and their shift to the next processing portion can be shortened, the shortenings of their processing times and the improvements of their qualities are can be realized. Also, by saving the carrying robots prepared ordinarily on the sides of the processing portions 6-9, since only one robot is used for concurrent uses for the plurality of processing portions 6-9, space saving and cutback of the cost of this apparatus can be realized.



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CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of the processed material characterized by throwing a processed material into the injection section of the production line which constituted two or more processing sections from connecting with a sheet conveyance device per cassette, conveying said processed material to the takeoff connection of said production line after said sheet conveyance device's receiving said every one processed material in each processing section alternatively, passing and processing sequentially, and containing to a cassette.

[Claim 2] The manufacturing installation of the processed material characterized by having constituted at least one production line from two or more processing sections

which can follow a processed material and can perform processing from which plurality differed being connected with a sheet conveyance device, and said sheet conveyance device carrying out a processed material to the ability of one being conveyed at a time alternatively at each processing section.

[Claim 3] The manufacturing installation of the processed material according to claim 2 whose processed material is a semi-conductor substrate and said whose processing section is either of the processings, such as washing performed to a semi-conductor substrate, membrane formation, resist spreading and development, exposure, heat treatment, impurity diffusion, CMP, plating, and inspection.

[Claim 4] The manufacturing installation of the processed material according to claim 3 with which the injection section which can throw in a processed material from the outside of a production line, and the takeoff connection which can take out a processed material from a production line were prepared in at least one processing section, respectively.

[Claim 5] The manufacturing installation of the processed material according to claim 4 with which the processing section which prepared the injection section or a takeoff connection was equipped with the function which contains two or more processed materials.

[Claim 6] The manufacturing installation of the processed material according to claim 5 as which the number of the sheet conveyance devices which it can convey one [at a time] is determined in a processed material by the processing time of two or more processing sections, and the conveyance time amount of a processed material.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the manufacture approach of a processed material and manufacturing installations which perform processing from which plurality differed to a processed material, and manufacture a product, such as a semi-conductor substrate manufacturing installation in a semi-conductor production process.

[0002]

[Description of the Prior Art] In manufacture of a semiconductor device, hundreds of processes various processings of various membrane formation, exposure, etching, inspection, etc. exist, and the processing sections also differ at each process. In the works in which these processing section is installed, the processing section serves as a layout which carries out intensive arrangement of the common processing section like for example, the washing processing section, and resist spreading, exposure and the development section and which is generally called a job shop. Drawing 3 shows the conventional example and 2 is the processing section in a cassette and the process which 6-9 followed.

[0003] A semi-conductor substrate is usually contained by the cassette 2 per 25 sheets, and between this processing section 6-9 is conveyed with automatic or a help per cassette.

[0004]

[Problem(s) to be Solved by the Invention] With the above-mentioned job shop layout, the processing section of a continuous process was distributing and there was a problem of the distance between each processing section having been long, and taking the time amount in connection with conveyance.

[0005] Even if it adopts the cluster tool which has two or more processing sections which it can process one sheet at a time for the semi-conductor substrate which arranges the continuous processing section continuously with the layout generally called a flow shop, and have increased in number in the processing section recently An injection is the semi-conductor substrate of a batch unit, and is set in the processing section. Conveyance to the following processing section was not completed until processing of the last semi-conductor substrate was completed, even if processing of a semi-conductor substrate of the 1st sheet was completed, but the processing conditions between the last semi-conductor substrates differed from the 1st sheet, and there was

a problem that dispersion will occur.

[0006] In the processing section and the processing [degree] section after the completion of processing, depending on the case where conveyance between the processing sections is not automated, arrangement of an operator is not appropriate, or the timing of processing termination is bad, the latency time occurred in the processing section, or the conveyance latency time of a processed material occurred in it, and the problem of time-necessary-for-completion delay of the operating ratio fall of the processing section and a processed material was also in it.

[0007] Therefore, the purpose of this invention is offering the manufacture approach of the processed material which quality's becomes uniform by making the processing conditions in the processing section regularity, and can aim at improvement in productivity by compaction of the processing time, and a manufacturing installation.

[0008]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the manufacture approach of the processed material this invention according to claim 1 In the injection section of the production line which constituted two or more processing sections from connecting with a sheet conveyance device A processed material is thrown in per cassette, after said sheet conveyance device's receiving said every one processed material in each processing section alternatively, passing and processing sequentially, said processed material is conveyed to the takeoff connection of said production line, and it is characterized by containing to a cassette.

[0009] Thus, since a sheet conveyance device receives alternatively the processed material thrown into the injection section of a production line per cassette in each one processing section of every, it is passed and is processed sequentially, every one processing from which the plurality in the continuous process differed can be performed to a processed material. For this reason, improvement in large compaction of the processing time and quality can be aimed at. Moreover, a processed material can be conveyed to the takeoff connection of a production line, and a processed material can be kept by containing to a cassette.

[0010] The manufacturing installation of a processed material according to claim 2 constitutes at least one production line from two or more processing sections which can follow a processed material and can perform processing from which plurality differed being connected with a sheet conveyance device, and is characterized by said sheet conveyance device carrying out a processed material to the ability of one being conveyed at a time alternatively at each processing section.

[0011] Thus, since the sheet conveyance device carried out the processed material to

the ability of one to be conveyed at a time alternatively at each processing section, every one processing from which the plurality in the continuous process differed can be performed to a processed material. For this reason, since the latency time until dispersion produced when a processed material is processed per batch like before is lost and it shifts to the processing section after the completion of processing and the following processing section can be shortened, improvement in large compaction of the processing time and quality can be aimed at. Moreover, since the carrier robot usually prepared for a processing section side is excluded and one robot can be made to serve a double purpose in two or more processing sections, reduction of space-saving and cost can be aimed at.

[0012] In claim 2, the manufacturing installation of a processed material according to claim 3 is a semi-conductor substrate, and its processed material is either of the processings, such as washing and membrane formation by which said processing section is given to a semi-conductor substrate, resist spreading and development, exposure, heat treatment, impurity diffusion, CMP, plating, and inspection. thus -- since a processed material is a semi-conductor substrate and the processing section is either of the processings, such as washing performed to a semi-conductor substrate, membrane formation, resist spreading and development, exposure, heat treatment, impurity diffusion, CMP, plating, and inspection, -- the production process of a semiconductor device -- can be and it can apply.

[0013] As for the manufacturing installation of a processed material according to claim 4, the injection section which can throw in a processed material from the outside of a production line in claim 3, and the takeoff connection which can take out a processed material from a production line were prepared in at least one processing section, respectively. Thus, since the injection section which can throw in a processed material from the outside of a production line, and the takeoff connection which can take out a processed material from a production line are prepared in at least one processing section, respectively, an injection of a processed material and ejection become possible through the processing section to a production line.

[0014] The manufacturing installation of a processed material according to claim 5 was equipped with the function in which the processing section which prepared the injection section or a takeoff connection contains two or more processed materials, in claim 4. Thus, since the processing section which prepared the injection section or a takeoff connection is equipped with the function which contains two or more processed materials, the processed material before and behind processing can be kept, and injection of a processed material and ejection can be performed easily.

[0015] In claim 5, as for the manufacturing installation of a processed material according to claim 6, the number of the sheet conveyance devices which it can convey one [at a time] is determined by the processing time of two or more processing sections, and the conveyance time amount of a processed material in a processed material. That is, if the conveyance time amount of a sheet conveyance device is smaller than the processing time of two or more processing sections, since a sheet conveyance device can be suppressed by one set, it is the capacity (processing time per sheet) of T and a manufacturing installation about total indicator of the conveyance time amount of a sheet conveyance device T1 When it carries out, it is the need number of a sheet conveyance device T/T1 It can express.

[0016]

[Embodiment of the Invention] The gestalt of implementation of this invention is explained based on drawing 1 and drawing 2 . Drawing 1 is the perspective view of the semi-conductor substrate manufacturing installation of the gestalt of implementation of this invention. drawing 1 -- setting -- 1 -- a semi-conductor substrate and 2 -- a cassette and 3 -- a sheet conveyance device and 3a -- for the injection section and 5, as for the processing section and 10, a takeoff connection, and 6-9 are [a semi-conductor substrate carrier robot and 3b / a rail and 4 / cage ENTA and 11] production lines. Two or more processing sections 6-9 are arranged with the layout of a flow shop, and can perform processing from which plurality differed succeeding the semi-conductor substrate 1 which is a processed material. For example, either of the processings, such as washing performed to the semi-conductor substrate 1, membrane formation, resist spreading and development, exposure, heat treatment, impurity diffusion, CMP, plating, and inspection, is performed in the processing sections 6-9. The processing sections 6-9 of these plurality constitute at least one production line 11 from being connected with the sheet conveyance device 3. In this case, the injection section 4 which can throw the semi-conductor substrate 1 into the processing sections 6 and 9 of the both ends of a production line 11 from the outside of a production line 11, and the takeoff connection 5 which can take out the semi-conductor substrate 1 from a production line 11 are arranged, respectively. The processing sections 6 and 9 which formed the injection section 4 or a takeoff connection 5 are equipped with the cassette 2 which can contain two or more semi-conductor substrates 1. Moreover, semi-conductor substrate carrier-robot 3a moves free [an attitude] in the rail 3b top installed in the front face of the processing sections 6-9, and, thereby, it can convey one semi-conductor substrate 1 at a time in each processing sections 6-9 alternatively.

[0017] Below, the semi-conductor substrate manufacture approach using the

manufacturing installation of the above-mentioned configuration is explained. As shown in drawing 1 , the semi-conductor substrate 1 is thrown into the injection section 4 per cassette, while it had been inserted in the cassette 2 by it. After the semi-conductor substrate carrier robot 3 doubles a location by cage ENTA 10 which samples the semi-conductor substrate 1 ** every out of a cassette 2, and is shown in drawing 2 , he reads ID stamped on the semi-conductor substrate 1, and conveys to the processing section 6. If it is processed and processing is completed, the semi-conductor substrate carrier robot 3 will take out the semi-conductor substrate 1, and will convey the semi-conductor substrate 1 thrown into the processing section 6 to the processing [degree] section 7. If this transfer is repeated to the processing section 9 and processing of the semi-conductor substrate 1 is completed in the processing section 9, the semi-conductor substrate carrier robot 3 will take out the semi-conductor substrate 1, and will convey to a takeoff connection 5. After doubling a location by cage ENTA 10 of a takeoff connection 5, and reading ID stamped on the semi-conductor substrate 1, the semi-conductor substrate 1 is contained to a cassette 2.

[0018] If the processing section in which the same processing is possible in a manufacturing installation recognizes two or more existence, the processing situation of the processing section can distribute the semi-conductor substrate 1 in a manufacturing installation. There is no constraint in the number of connection of the processing section of this manufacturing installation. Moreover, even if the injection section 4 and a takeoff connection 5 may be separate and it makes them serve a double purpose by one, they are not cared about. Arrangement may not be both ends, either or the injection section 4 and a takeoff connection 5 may be formed in pars intermedia. Moreover, although the processing conditions in each processing section of the semi-conductor substrate 1 are judged by ID of the semi-conductor substrate 1 at the time of an injection and it is controlled by progress of each semi-conductor substrate 1, as long as processing conditioning is unnecessary, there may not be ID recognition.

[0019] The processing sections 6-9 of the process which continues with the gestalt of this operation are located in a line, the processing section 6 and the processing section 7 are the processing sections which perform the same processing, and all routing counters are 3. For the processing section 6 and the processing section 7, 5 minutes/sheet and the processing section 8 are [2 minutes/sheet and the processing section 9 of a throughput] 3 minutes/sheet respectively. Since the processing sections 6 and 7 can be processed the same, capacity becomes twice and it becomes a sheet in 2.5 minutes /, the capacity of this manufacturing installation becomes the bottleneck processing section 9 in 3 minutes/[a sheet and] in all.

[0020] Generally, as for the throughput of each processing section, it is desirable to suppress and arrange dispersion, if the improvement in an operating ratio of the processing section is taken into consideration, the processing section of a bottleneck also improves, effectiveness is gathered, and striving for the improvement in capacity is called for.

[0021] Moreover, equipment 6 and equipment 7 are equipment which can carry out the same processing of the same process as mentioned above. In the case of the conventional example, the batches which are an injection unit to equipment are [batch 4 cassette and the equipment 9 of one cassette and equipment 8] batch 1 cassettes. Although the injection unit to each equipment is a cassette, processing cannot be started if four cassettes which processing of equipments 6 and 7 finished with equipment 8 are not assembled. Therefore, the processing time of one cassette in this Rhine must be totaled to the latency time not only in the sum total of the processing time per cassette of each equipment but intermediate equipment 8. Therefore, 1 cassette processing time is computable by (processing time for 4 in equipments 6 and 7 cassettes) +(processing time for four cassettes in equipment 8)+ (processing time for one cassette in equipment 9).

[0022] In the case of the gestalt of this operation, the injection unit of all equipments performs injection ejection to each equipment with a fixed time interval with one wafer. Therefore, the processing time can compute the processing time per sheet, if the residence time in equipment which is the processing time in each equipment is totaled. The processing time per cassette is computable if x24 which are the time amount to which the 24 remaining sheets are equal to the processing time per sheet (injection ejection spacing) are added.

[0023] Therefore, since time amount until four processed cassettes are assembled in equipments 6 and 7 becomes processing-time 93 minutes of equipment 9 for processing-time 150 minutes of equipment 8 for 369 minutes in the case of the conventional example, the processing time of one cassette becomes 612 minutes. On the other hand, with the gestalt of this operation, the processing time per sheet can shorten the processing time sharply with 168 minutes also by the processing time per cassette for 96 minutes.

[0024] total indicator (conveyance the takeoff connection 5 from the processing section 9 ··) of a semi-conductor substrate carrier robot's conveyance time amount If conveyance to the processing section 8 from conveyance to the processing section 6 or the processing section 7 from the migration in the injection section 4 from a takeoff connection 5 and the injection section 4, the processing section 6, or the processing

section 7 and conveyance to the processing section 9 from the processing section 8 are set to T If it is the capacity (processing time per sheet) of T< manufacturing installation, the semi-conductor substrate carrier robot of this manufacturing installation can hold down to one set. On the contrary, it is possible to express with the capacity of number of semi-conductor substrate carrier-robot need =T / manufacturing installation, and it becomes a robot's conveyance capacity increase and the index of the cost reduction by it.

[0025] Moreover, it is also possible to make it the partial clean configuration in which the conveyance field of this semi-conductor substrate was enclosed, it maintained to the cleanliness of the 0.1-micrometer class 1, and the exterior was dropped on class 1,000 level. Thereby, both the investment frames and sustaining costs of a clean room can be held down.

[0026] Since the sheet conveyance device 3 carried out the semi-conductor substrate 1 to the ability of one sheet to be conveyed at a time alternatively as mentioned above at each processing sections 6-9 according to the gestalt of this operation, it can perform at a time one processing from which the plurality in the continuous process differed to the semi-conductor substrate 1. For this reason, since the latency time until dispersion produced when the semi-conductor substrate 1 is processed per batch like before is lost and it shifts to the processing section after the completion of processing and the following processing section can be shortened, improvement in large compaction of the processing time and quality can be aimed at. Moreover, since the carrier robot usually prepared for a processing section side is excluded and one robot can be made to serve a double purpose in two or more processing sections, reduction of space-saving and cost can be aimed at.

[0027] In addition, although the semi-conductor substrate was explained as a processed material, electronic parts other than this etc. are sufficient.

[0028]

[Effect of the Invention] Since according to the manufacture approach of the processed material this invention according to claim 1 a sheet conveyance device receives alternatively the processed material thrown into the injection section of a production line per cassette in each one processing section of every, it is passed and is processed sequentially, every one processing from which the plurality in the continuous process differed can be performed to a processed material. For this reason, improvement in large compaction of the processing time and quality can be aimed at. Moreover, a processed material can be conveyed to the takeoff connection of a production line, and a processed material can be kept by containing to a cassette.

[0029] According to the manufacturing installation of the processed material of this invention according to claim 2, since the sheet conveyance device carried out the processed material to the ability of one to be conveyed at a time alternatively at each processing section, every one processing from which the plurality in the continuous process differed can be performed to a processed material. For this reason, since the latency time until dispersion produced when a processed material is processed per batch like before is lost and it shifts to the processing section after the completion of processing and the following processing section can be shortened, improvement in large compaction of the processing time and quality can be aimed at. Moreover, since the carrier robot usually prepared for a processing section side is excluded and one robot can be made to serve a double purpose in two or more processing sections, reduction of space-saving and cost can be aimed at.

[0030] since a processed material is a semi-conductor substrate and the processing section is either of the processings, such as washing performed to a semi-conductor substrate, membrane formation, resist spreading and development, exposure, heat treatment, impurity diffusion, CMP, plating, and inspection, in claim 3 -- the production process of a semiconductor device -- can be and it can apply.

[0031] In claim 4, since the injection section which can throw in a processed material from the outside of a production line, and the takeoff connection which can take out a processed material from a production line are prepared in at least one processing section, respectively, an injection of a processed material and ejection become possible through the processing section to a production line.

[0032] In claim 5, since the processing section which prepared the injection section or a takeoff connection is equipped with the function which contains two or more processed materials, the processed material before and behind processing can be kept, and injection of a processed material and ejection can be performed easily.

[0033] In claim 6, the number of the sheet conveyance devices which it can convey one [at a time] is determined by the processing time of two or more processing sections, and the conveyance time amount of a processed material in a processed material. That is, if the conveyance time amount of a sheet conveyance device is smaller than the processing time of two or more processing sections, since a sheet conveyance device can be suppressed by one set, it is the capacity (processing time per sheet) of T and a manufacturing installation about total indicator of the conveyance time amount of a sheet conveyance device T1 When it carries out, it is the need number of a sheet conveyance device T/T1 It can express. This becomes the improvement in conveyance capacity of a sheet conveyance device, and the index of the cost reduction by it.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view of the semi-conductor substrate manufacturing installation of the gestalt of implementation of this invention.
[Drawing 2] It is the explanatory view showing cage ENTA in the gestalt of implementation of this invention.
[Drawing 3] It is the perspective view of the semi-conductor substrate manufacturing installation of the conventional example.
[Description of Notations]
1 Semi-conductor Substrate
2 Cassette
3 Semi-conductor Substrate Carrier Robot
4 Injection Section
5 Fetch Section
6 Processing Section
7 Processing Section
8 Processing Section
9 Processing Section
10 Cage ENTA
11 Production Line

[Translation done.]

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審査請求　未請求　請求項の数６　ＯＬ　（全　６　頁）

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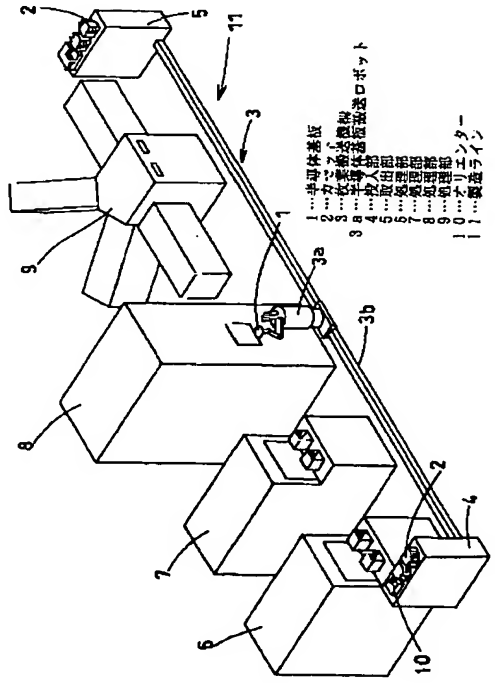
最終頁に続く

(54)【発明の名称】　被処理物の製造方法と製造装置

(57)【要約】
【課題】　処理部での処理条件を一定にすることで品質が均一となり、処理時間の短縮により生産性の向上を図る。
【解決手段】　複数の異なった処理を半導体基板１に連続して施すことができる複数の処理部６～９が枚葉搬送機構３で結ばれることで少なくとも一つの製造ライン１１を構成し、枚葉搬送機構３が選択的に個々の処理部６～９に半導体基板１を一つずつ搬送可能とした。これにより、従来のように半導体基板１をバッチ単位で処理した場合に生じるばらつきがなくなり、また処理完了後の処理部と次の処理部に移行するまでの待ち時間を短縮できるので、処理時間の大幅な短縮と品質の向上を図ることができる。また、処理部側に通常準備される搬送ロボットを省いて１台のロボットを複数の処理部で兼用できるため、省スペースとコストの削減を図ることができる。



【特許請求の範囲】
【請求項１】　複数の処理部を枚葉搬送機構で結ぶことで構成した製造ラインの投入部に、被処理物をカセット単位で投入し、前記枚葉搬送機構により選択的に個々の処理部に前記被処理物を一つずつ受け渡して順次処理した後、前記製造ラインの取出し部に前記被処理物を搬送し、カセットに収納することを特徴とする被処理物の製造方法。
【請求項２】　複数の異なった処理を被処理物に連続して施すことができる複数の処理部が枚葉搬送機構で結ばれることで少なくとも一つの製造ラインを構成し、前記枚葉搬送機構が選択的に個々の処理部に被処理物を一つずつ搬送可能としたことを特徴とする被処理物の製造装置。
【請求項３】　被処理物が半導体基板であり、前記処理部が、半導体基板に施される洗浄、成膜、レジスト塗布・現像、露光、熱処理、不純物拡散、ＣＭＰ、めっき、検査等の処理のうちのいずれかである請求項２記載の被処理物の製造装置。
【請求項４】　製造ライン外から被処理物を投入することができる投入部と、製造ラインから被処理物を取り出すことができる取出し部とがそれぞれ少なくとも一つの処理部に設けられた請求項３記載の被処理物の製造装置。
【請求項５】　投入部もしくは取出し部を設けた処理部が、複数の被処理物を収納する機能を備えた請求項４記載の被処理物の製造装置。
【請求項６】　被処理物を一つずつ搬送可能な枚葉搬送機構の数が、複数の処理部の処理時間と被処理物の搬送時間によって決定される請求項５記載の被処理物の製造装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、特に、半導体製造工程における半導体基板製造装置など、複数の異なった処理を被処理物に施して製品を製造する被処理物の製造方法と製造装置に関するものである。
【０００２】
【従来の技術】半導体装置の製造においては各種成膜、露光、エッチング、検査等の様々な処理が数百工程存在し、処理部も各々の工程で異なっている。これら処理部が設置される工場内では、処理部は例えば洗浄処理部、レジスト塗布・露光・現像処理部のように、共通する処理部を集中配置する一般にジョブショップと呼ばれるレイアウトとなっている。図３はその従来例を示し、２はカセット、６～９は連続した工程における処理部である。
【０００３】半導体基板は通常２５枚単位でカセット２に収納され、この処理部６～９間をカセット単位で自動若しくは人手で搬送されている。
【０００４】
【発明が解決しようとする課題】上記ジョブショップレイアウトでは、連続する工程の処理部が分散しており、各処理部間の距離が長く、搬送に関わる時間がかかるという問題があった。
【０００５】連続する処理部を一般にフローショップと呼ばれるレイアウトで連続して配置し、処理部に最近増えてきた半導体基板を１枚づつ処理可能な複数の処理部を有するクラスターツールを採用したとしても、投入はバッチ単位の半導体基板であり、処理部においては、１枚目の半導体基板の処理が完了しても最終の半導体基板の処理が完了するまで次の処理部への搬送が出来ず、１枚目と最終の半導体基板間での処理条件が異なり、ばらつきが発生してしまうという問題があった。
【０００６】処理部間の搬送が自動化されていなかったり、作業者の配置が適当でなかったり、処理終了のタイミングが悪かったりする場合によっては、処理完了後の処理部と次処理部で処理部に待ち時間が発生したり、被処理物の搬送待ち時間が発生し、処理部の稼働率低下と被処理物の工期遅延という問題もあった。
【０００７】したがって、この発明の目的は、処理部での処理条件を一定にすることで品質が均一となり、処理時間の短縮により生産性の向上を図ることができる被処理物の製造方法と製造装置を提供することである。
【０００８】
【課題を解決するための手段】上記課題を解決するために、この発明の請求項１記載の被処理物の製造方法は、複数の処理部を枚葉搬送機構で結ぶことで構成した製造ラインの投入部に、被処理物をカセット単位で投入し、前記枚葉搬送機構により選択的に個々の処理部に前記被処理物を一つずつ受け渡して順次処理した後、前記製造ラインの取出し部に前記被処理物を搬送し、カセットに収納することを特徴とする。
【０００９】このように、製造ラインの投入部にカセット単位で投入した被処理物を枚葉搬送機構により選択的に個々の処理部に一つずつ受け渡して順次処理するので、連続した工程における複数の異なった処理を被処理物に対して１つずつ行うことができる。このため、処理時間の大幅な短縮と品質の向上を図ることができる。また、製造ラインの取出し部に被処理物を搬送し、カセットに収納することで、被処理物を保管しておくことができる。
【００１０】請求項２記載の被処理物の製造装置は、複数の異なった処理を被処理物に連続して施すことができる複数の処理部が枚葉搬送機構で結ばれることで少なくとも一つの製造ラインを構成し、前記枚葉搬送機構が選択的に個々の処理部に被処理物を一つずつ搬送可能としたことを特徴とする。
【００１１】このように、枚葉搬送機構が選択的に個々の処理部に被処理物を一つずつ搬送可能としたので、連

続した工程における複数の異なった処理を被処理物に対して１つずつ行うことができる。このため、従来のように被処理物をバッチ単位で処理した場合に生じるばらつきがなくなり、また処理完了後の処理部と次の処理部に移行するまでの待ち時間を短縮できるので、処理時間の大幅な短縮と品質の向上を図ることができる。また、処理部側に通常準備される搬送ロボットを省いて１台のロボットを複数の処理部で兼用できるため、省スペースとコストの削減を図ることができる。

【００１２】請求項３記載の被処理物の製造装置は、請求項２において、被処理物が半導体基板であり、前記処理部が、半導体基板に施される洗浄、成膜、レジスト塗布・現像、露光、熱処理、不純物拡散、ＣＭＰ、めっき、検査等の処理のうちのいずれかである。このように、被処理物が半導体基板であり、処理部が、半導体基板に施される洗浄、成膜、レジスト塗布・現像、露光、熱処理、不純物拡散、ＣＭＰ、めっき、検査等の処理のうちのいずれかであるので、半導体装置の製造工程おいて適用できる。

【００１３】請求項４記載の被処理物の製造装置は、請求項３において、製造ライン外から被処理物を投入することができる投入部と、製造ラインから被処理物を取り出すことができる取出し部とがそれぞれ少なくとも一つの処理部に設けられた。このように、製造ライン外から被処理物を投入することができる投入部と、製造ラインから被処理物を取り出すことができる取出し部とがそれぞれ少なくとも一つの処理部に設けられているので、製造ラインに対して被処理物の投入と取り出しが処理部を通じて可能となる。

【００１４】請求項５記載の被処理物の製造装置は、請求項４において、投入部もしくは取出し部を設けた処理部が、複数の被処理物を収納する機能を備えた。このように、投入部もしくは取出し部を設けた処理部が、複数の被処理物を収納する機能を備えているので、処理前後の被処理物を保管しておくことができ、被処理物の投入と取り出しが容易に行える。

【００１５】請求項６記載の被処理物の製造装置は、請求項５において、被処理物を一つずつ搬送可能な枚葉搬送機構の数が、複数の処理部の処理時間と被処理物の搬送時間によって決定される。すなわち、枚葉搬送機構の搬送時間が複数の処理部の処理時間より小さければ、枚葉搬送機構は１台で抑えることができるので、枚葉搬送機構の搬送時間の総合計をＴ、製造装置の能力（１枚当たりの処理時間）をT_1とすると、枚葉搬送機構の必要台数をT/T_1により表すことができる。

【００１６】

【発明の実施の形態】この発明の実施の形態を図１および図２に基づいて説明する。図１はこの発明の実施の形態の半導体基板製造装置の斜視図である。図１において、１は半導体基板、２はカセット、３は枚葉搬送機構、３ａは半導体基板搬送ロボット、３ｂはレール、４は投入部、５は取出し部、６～９は処理部、１０はオリエンター、１１は製造ラインである。複数の処理部６～９は、フローショップのレイアウトで配置され、複数の異なった処理を被処理物である半導体基板１に連続して施すことができる。例えば、半導体基板１に施される洗浄、成膜、レジスト塗布・現像、露光、熱処理、不純物拡散、ＣＭＰ、めっき、検査等の処理のうちのいずれかを処理部６～９で行う。これら複数の処理部６～９は、枚葉搬送機構３で結ばれることで少なくとも一つの製造ライン１１を構成している。この場合、製造ライン１１の両端の処理部６，９に製造ライン１１外から半導体基板１を投入することができる投入部４と、製造ライン１１から半導体基板１を取り出すことができる取出し部５とがそれぞれ配置されている。投入部４もしくは取出し部５を設けた処理部６，９は、複数の半導体基板１を収納できるカセット２を備えている。また、処理部６～９の前面に設置したレール３ｂ上を半導体基板搬送ロボット３ａが進退自在に移動し、これにより選択的に個々の処理部６～９に半導体基板１を一枚ずつ搬送できる。

【００１７】つぎに、上記構成の製造装置を用いた半導体基板製造方法について説明する。図１に示すように、半導体基板１はカセット２に挿入されたまま投入部４にカセット単位で投入される。半導体基板搬送ロボット３は、カセット２の中から半導体基板１を枚づつ抜き取って図２に示すオリエンター１０で位置を合わせた後、半導体基板１に刻印されたＩＤを読み取って処理部６へと搬送する。処理部６に投入された半導体基板１は処理され、処理が完了すると半導体基板搬送ロボット３が半導体基板１を取り出して次処理部７へ搬送する。この移載を処理部９まで繰り返し、処理部９で半導体基板１の処理が完了すると半導体基板搬送ロボット３が半導体基板１を取り出して取出し部５へ搬送する。取出し部５のオリエンター１０で位置を合わせた後、半導体基板１に刻印されたＩＤを読み取ってから半導体基板１をカセット２へ収納する。

【００１８】製造装置の中で同一の処理が可能な処理部が複数存在すれば、製造装置の中で半導体基板１はその処理部の処理状況によって振り分けられる。本製造装置の処理部の接続数に制約は無い。また、投入部４と取出し部５は別々でも良いし、一つで兼用しても構わない。配置も両端でなくても、中間部に投入部４と取出し部５を設けても良い。また、半導体基板１の各処理部における処理条件は、投入時の半導体基板１のＩＤにより判断され、個々の半導体基板１の進捗により制御されるが、処理条件設定が不要であればＩＤ認識が無くても良い。

【００１９】この実施の形態では連続する工程の処理部６～９が並んでおり、処理部６と処理部７は同一処理を行う処理部で、全工程数は３である。処理能力は処理部６、処理部７が各々５分／枚、処理部８が２分／枚、処

理部９が３分／枚である。処理部６，７は同一処理が可能で能力は２倍となり、２．５分／枚となる為、この製造装置の能力はボトルネック処理部９に合わせて３分／枚となる。

【００２０】一般に各処理部の処理能力は、処理部の稼働率向上を考慮するとばらつきを抑えて揃えることが望ましく、ボトルネックの処理部も改善して効率を上げ、能力向上に努めることが求められる。

【００２１】また、上記のように装置６と装置７は同一工程の同一処理できる装置である。従来例の場合、装置への投入単位である処理単位は１カセット、装置８は処理単位４カセット、装置９は処理単位１カセットである。各装置への投入単位はカセットであるが、装置８では装置６，７の処理が終わったカセットが４個揃わなければ処理を開始できない。そのためこのラインでの１カセットの処理時間は、各装置の１カセット当たりの処理時間の合計だけではなく、途中の装置８での待ち時間まで合計しなければならない。従って、（装置６，７での４カセット分の処理時間）＋（装置８での４カセット分の処理時間）＋（装置９での１カセット分の処理時間）で１カセット処理時間が算出できる。

【００２２】この実施の形態の場合、全ての装置の投入単位はウェハ１枚で各装置には一定時間間隔で投入取り出しを行う。そのため、処理時間は各装置での処理時間である装置内滞在時間を合計すれば１枚当たりの処理時間が算出できる。１カセット当たりの処理時間は、１枚当たりの処理時間に残りの２４枚が揃う時間である（投入取り出し間隔）×２４を加えれば算出できる。

【００２３】したがって従来例の場合、装置６，７において処理済みカセットが４個揃うまでの時間は３６９分、装置８の処理時間１５０分、装置９の処理時間９３分となるので、１カセットの処理時間は６１２分となる。これに対してこの実施の形態では、１枚当たりの処理時間は９６分、１カセット当たりの処理時間でも１６８分と大幅に処理時間を短縮することができる。

【００２４】半導体基板搬送ロボットの搬送時間の総合計（処理部９から取出し部５への搬送、取出し部５から投入部４への移動、投入部４から処理部６または処理部７への搬送、処理部６または処理部７から処理部８への搬送、処理部８から処理部９への搬送）をＴとすると、Ｔ＜製造装置の能力（１枚当たりの処理時間）であれば、この製造装置の半導体基板搬送ロボットは１台に抑えることが出来る。逆に、半導体基板搬送ロボット必要台数＝Ｔ／製造装置の能力で表すことが可能で、ロボットの搬送能力アップとそれによるコスト削減の指標となる。

【００２５】またこの半導体基板の搬送領域を囲って０．１μｍクラス１の清浄度に維持し、外部をクラス１，０００レベルに落とした局所クリーン構成にすることも可能である。これにより、クリーンルームの投資金額と維持費を共に抑えることができる。

【００２６】以上のようにこの実施の形態によれば、枚葉搬送機構３が選択的に個々の処理部６～９に半導体基板１を一枚ずつ搬送可能としたので、連続した工程における複数の異なった処理を半導体基板１に対して１枚ずつ行うことができる。このため、従来のように半導体基板１をバッチ単位で処理した場合に生じるばらつきがなくなり、また処理完了後の処理部と次の処理部に移行するまでの待ち時間を短縮できるので、処理時間の大幅な短縮と品質の向上を図ることができる。また、処理部側に通常準備される搬送ロボットを省いて１台のロボットを複数の処理部で兼用できるため、省スペースとコストの削減を図ることができる。

【００２７】なお、被処理物として半導体基板について説明したがこれ以外の電子部品等でもよい。

【００２８】

【発明の効果】この発明の請求項１記載の被処理物の製造方法によれば、製造ラインの投入部にカセット単位で投入した被処理物を枚葉搬送機構により選択的に個々の処理部に一つずつ受け渡して順次処理するので、連続した工程における複数の異なった処理を被処理物に対して１つずつ行うことができる。このため、処理時間の大幅な短縮と品質の向上を図ることができる。また、製造ラインの取出し部に被処理物を搬送し、カセットに収納することで、被処理物を保管しておくことができる。

【００２９】この発明の請求項２記載の被処理物の製造装置によれば、枚葉搬送機構が選択的に個々の処理部に被処理物を一つずつ搬送可能としたので、連続した工程における複数の異なった処理を被処理物に対して１つずつ行うことができる。このため、従来のように被処理物をバッチ単位で処理した場合に生じるばらつきがなくなり、また処理完了後の処理部と次の処理部に移行するまでの待ち時間を短縮できるので、処理時間の大幅な短縮と品質の向上を図ることができる。また、処理部側に通常準備される搬送ロボットを省いて１台のロボットを複数の処理部で兼用できるため、省スペースとコストの削減を図ることができる。

【００３０】請求項３では、被処理物が半導体基板であり、処理部が、半導体基板に施される洗浄、成膜、レジスト塗布・現像、露光、熱処理、不純物拡散、ＣＭＰ、めっき、検査等の処理のうちのいずれかであるので、半導体装置の製造工程おいて適用できる。

【００３１】請求項４では、製造ライン外から被処理物を投入することができる投入部と、製造ラインから被処理物を取り出すことができる取出し部とがそれぞれ少なくとも一つの処理部に設けられているので、製造ラインに対して被処理物の投入と取り出しが処理部を通じて可能となる。

【００３２】請求項５では、投入部もしくは取出し部を設けた処理部が、複数の被処理物を収納する機能を備え

ているので、処理前後の被処理物を保管しておくことができ、被処理物の投入と取り出しが容易に行える。

【００３３】請求項６では、被処理物を一つずつ搬送可能な枚葉搬送機構の数が、複数の処理部の処理時間と被処理物の搬送時間によって決定される。すなわち、枚葉搬送機構の搬送時間が複数の処理部の処理時間より小さければ、枚葉搬送機構は１台で抑えることができるので、枚葉搬送機構の搬送時間の総合計をＴ、製造装置の能力（１枚当たりの処理時間）をT_1 とすると、枚葉搬送機構の必要台数をT/T_1 により表すことができる。これにより、枚葉搬送機構の搬送能力向上とそれによるコスト削減の指標となる。

【図面の簡単な説明】

【図１】この発明の実施の形態の半導体基板製造装置の斜視図である。

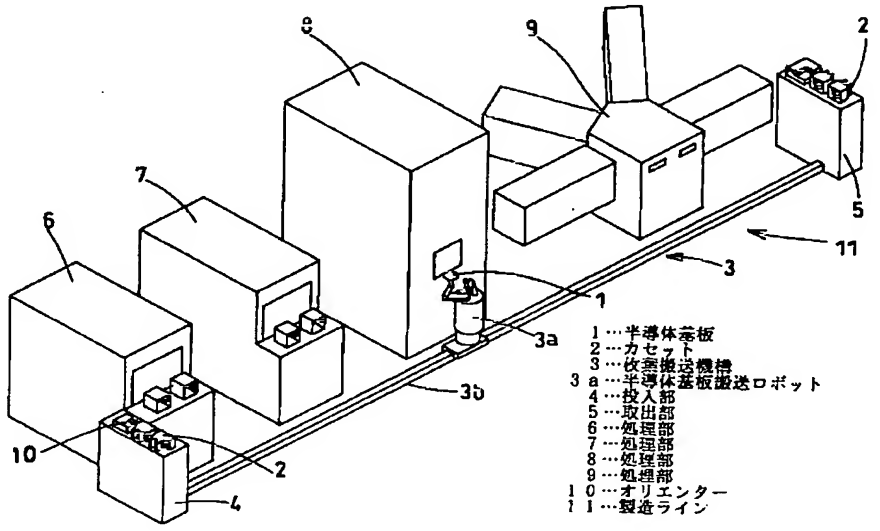
【図２】この発明の実施の形態においてオリエンターを示す説明図である。

【図３】従来例の半導体基板製造装置の斜視図である。

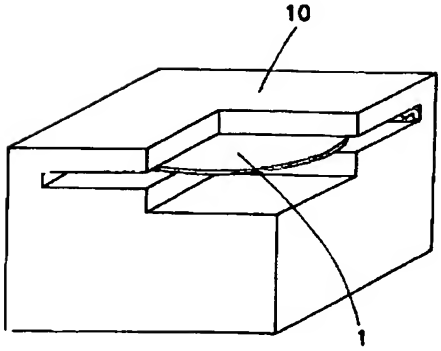
【符号の説明】

１　半導体基板
２　カセット
３　半導体基板搬送ロボット
４　投入部
５　取出部
６　処理部
７　処理部
８　処理部
９　処理部
１０　オリエンター
１１　製造ライン

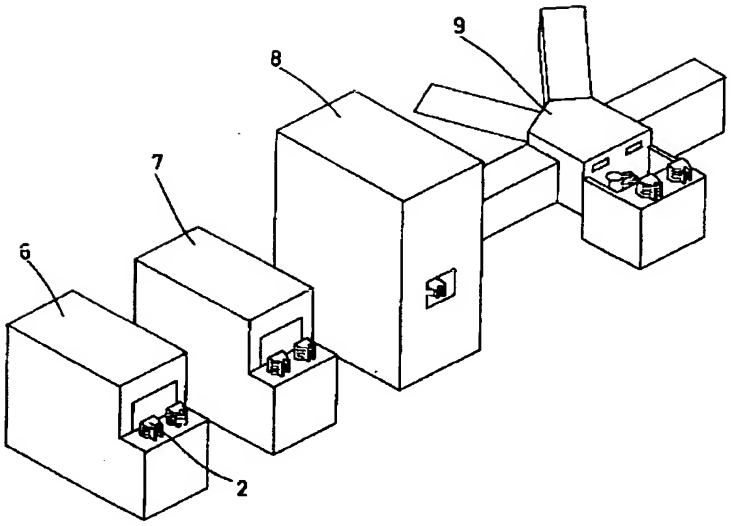
【図１】



【図２】



【図3】



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Ｆターム(参考)　5F031 CA02 FA01 FA07 FA11 FA12
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